

Historical overview of IWT regulations

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28 June 2021

Webinar IWT's Greening Challenges and Stage V - Perfect match or not?

CCNR I emission limit values

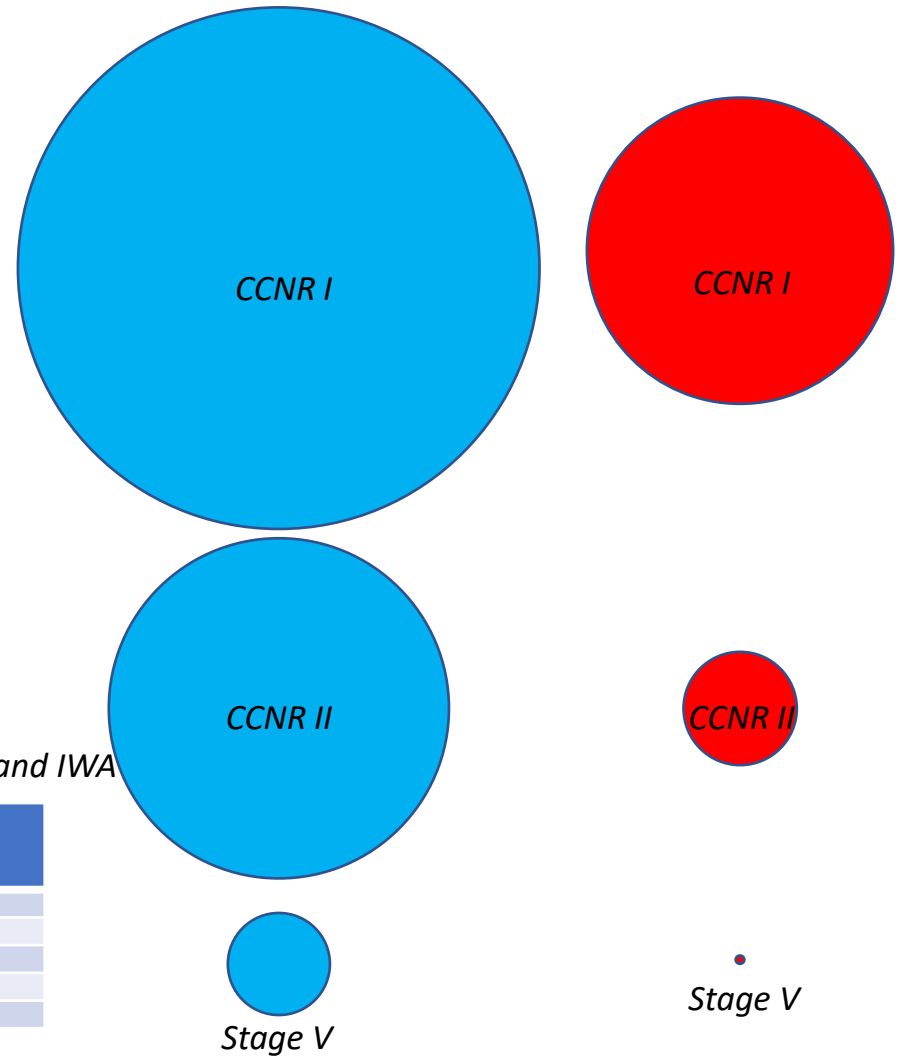
Power range	CO	HC	NO _x	PM
(kW)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)
37≤P<75	6.5	1.3	9.2	0.85
75≤P<130	5.0	1.3	9.2	0.70
P≥300	5.0	1.3	n ≥ 2800 min ⁻¹ = 9,2 500 ≤ n < 2800 min ⁻¹ = 45 * n -0.2	0.54

CCNR II emission limit values

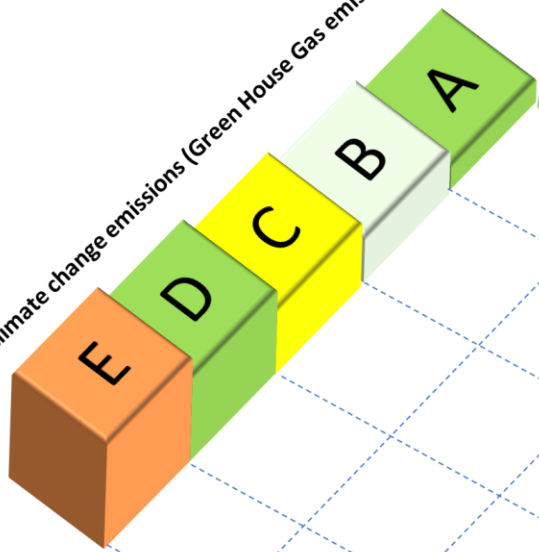
Power range	CO	HC	NO _x	PM
(kW)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)
19≤P<37	5.5	1.5	8.0	0.8
37≤P<75	5.0	1.3	7.0	0.4
75≤P<130	5.0	1.0	6.0	0.2
130≤P<560	3.5	1.0	6.0	0.2
P≥560	3.5	1.0	n ≥ 3150 min ⁻¹ = 6,0 343 ≤ n < 3150 min ⁻¹ = 45 n -0.2 - 3 n < 343 min ⁻¹ = 11,0	0.2

EU NRMM Stage V emission standards for engine types IWP and IWA

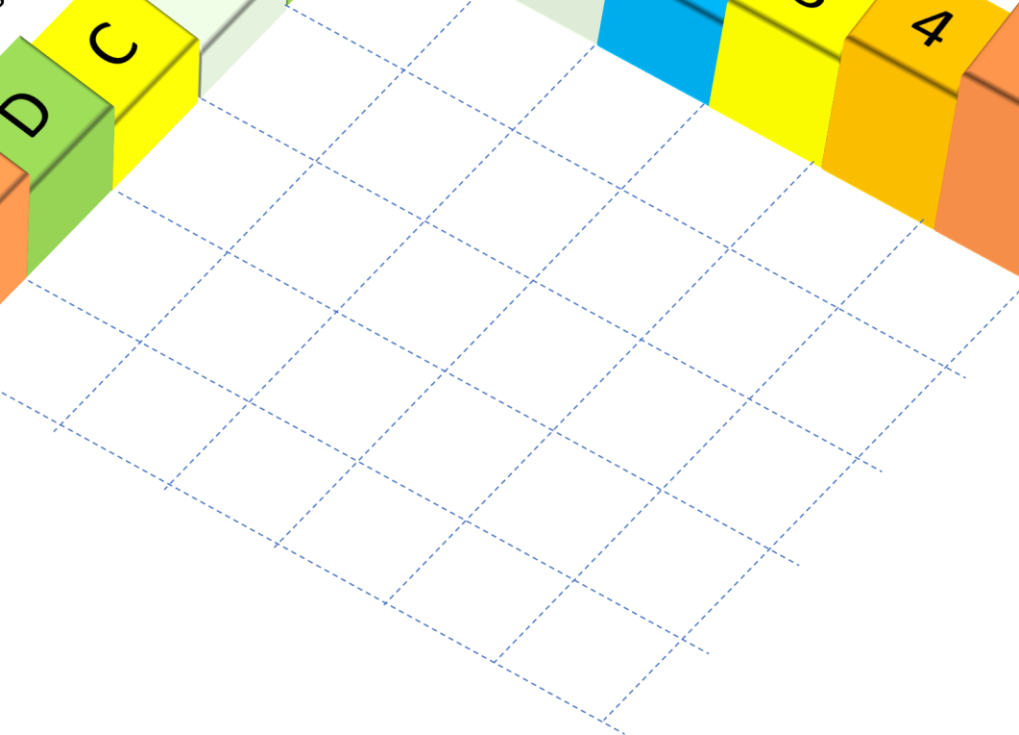
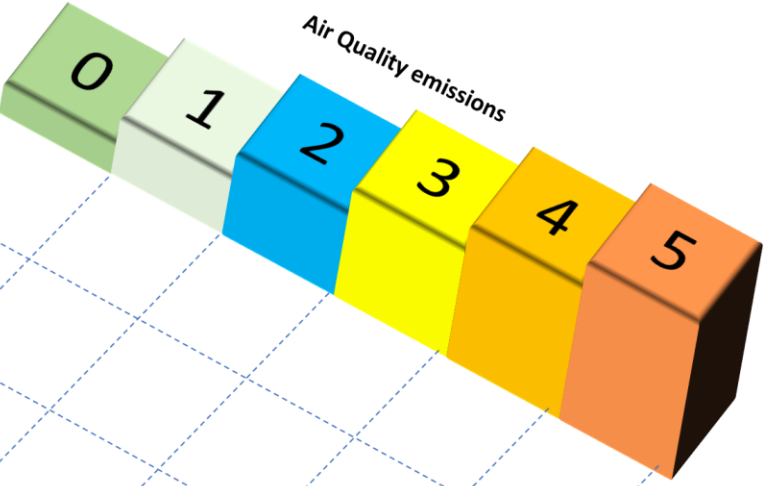
Power range	Engine ignition type	CO	HC	NO _x	PM mass	PN	A
(kW)	(-)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)	(1/kWh)	(-)
19≤P<75	all	5	(HC + NO _x ≤ 4.70)	0.3	-	6	
75≤P<130	all	5	(HC + NO _x ≤ 5.40)	0.14	-	6	
130≤P<300	all	3.5	1	2.1	0.1	-	6
P≥300	all	3.5	0.19	1.8	0.015	1x10 ¹²	6



Climate change emissions (Green House Gas emissions)



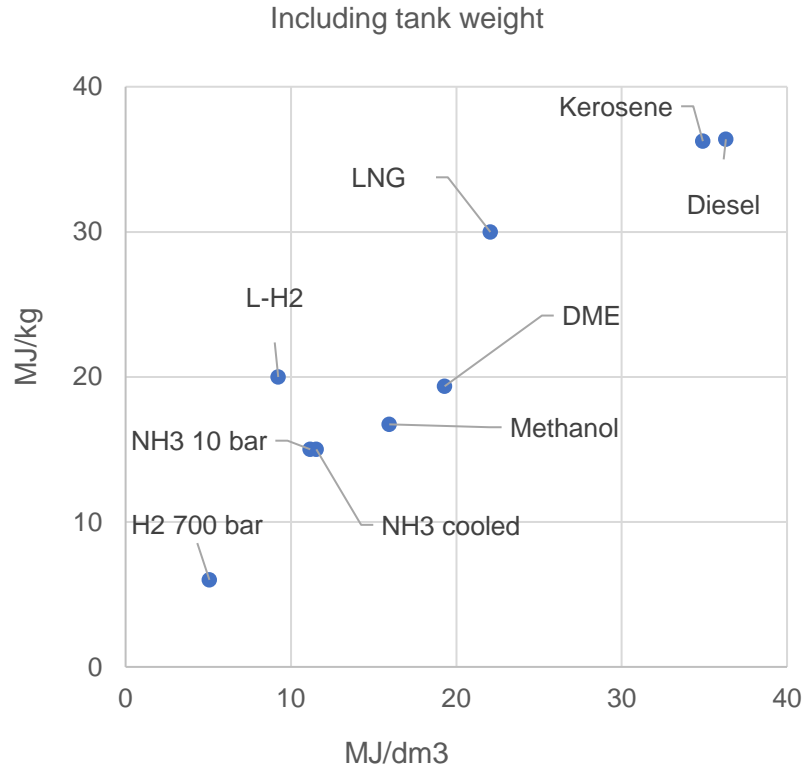
Air Quality emissions



NRMM STAGE V: REGULATION (EU) 2016/1628

- **Engine Categories:**
- **‘category IWP’:**
- (a) engines exclusively for use in inland waterway vessels, for their direct or indirect propulsion, or intended for their direct or indirect propulsion, having a reference power that is greater than or equal to 19 kW;
- (b) engines used in place of engines of category IWA.
- **‘category IWA’:**
- auxiliary engines exclusively for use in inland waterway vessels and having a reference power that is greater than or equal to 19 kW;
- **‘category NRE’:**
- (a) engines for non-road mobile machinery
- (b) engines having a reference power of less than 560 kW used in the place of Stage V engines of categories **IWP, IWA, RLL or RLR**;

Energy density of fuels - practical application



Factor compared to diesel fuel	Volume factor based	Packaging factor ship	Volume incl. space factor
Methanol	2,3	1	2,3
LNG	1,6	2	3,2
NH3 cooled	3,1	1.1	3,1
NH3 10 bar	3,1	2	6,3
cryogenic H2	6,3	2	12,5
comp. H2 700 bar	7,1	2,5	17,7
comp. H2 350 bar	12,5	2,5	31
Battery	50	2	100



Energy Transition

